

- 44 -

CLAIMS

1. A heterologous cellulase fusion construct encoding a cellulase fusion protein, in operable linkage from the 5' end of said construct, comprising:
  - (a) a DNA molecule encoding a signal sequence;
  - (b) a DNA molecule encoding a catalytic domain of an exo-cellobiohydrolase; and
  - (c) a DNA molecule encoding an encoding a second catalytic domainwherein said second catalytic domain is the catalytic domain of a cellulase enzyme.
2. The heterologous cellulase fusion construct of Claim 1 further comprising a linker sequence located 3' of the first catalytic domain and 5' of the second catalytic domain.
3. The heterologous cellulase fusion construct of Claim 1 wherein the exo-cellobiohydrolase lacks a cellulose binding domain (CBD).
4. The heterologous cellulase fusion construct of Claim 2 further comprising a kexin site located after the linker sequence and before the second catalytic domain.
5. The heterologous cellulase fusion construct of Claim 1 further comprising a promoter of a filamentous fungus secretable protein, said promoter located in operable linkage 5' of the first catalytic domain.
6. The heterologous cellulase fusion construct of Claim 5 wherein the promoter is a *cbh* promoter.
7. The heterologous cellulase fusion construct of Claim 6 wherein the promoter is a *cbh1* promoter derived from *T. reesei*.
8. The heterologous cellulase fusion construct of Claim 1 wherein the first catalytic domain is derived from a CBH1 exo-cellobiohydrolase.

- 45 -

9. The heterologous cellulase fusion construct of Claim 8 wherein the first catalytic domain is derived from a CBH1 having an amino acid sequence of at least 90% sequence identity with the sequence set forth in SEQ ID NO.: 6.

10. The heterologous cellulase fusion construct of Claim 1 wherein the second catalytic domain is an endoglucanase catalytic domain.

11. The heterologous cellulase fusion construct of Claim 10 wherein the second catalytic domain is an exo-cellbiohydrolase catalytic domain.

12. The heterologous cellulase fusion construct of Claim 10 wherein the second catalytic domain is derived from a bacterial cellulase.

13. The heterologous cellulase fusion construct of Claim 10 wherein the second catalytic domain is selected from the group consisting of an *Acidothermus cellulolyticus* GH5A endoglucanase I (E1) catalytic domain; an *Acidothermus cellulolyticus* GH48 (GH48) cellulase catalytic domain; an *Acidothermus cellulolyticus* GH74 endoglucanase (GH74-EG) catalytic domain; a *Thermobifida fusca* E3 (Tf-E3) cellulase catalytic domain; and a *Thermobifida fusca* E5 endoglucanase (Tf-E5) catalytic domain.

14. The heterologous cellulase fusion construct of Claim 1 wherein the heterologous cellulase fusion construct lacks the cellulose binding domain of the exo-cellbiohydrolase of the first catalytic domain and the cellulose binding domain of the cellulase of the second catalytic domain.

15. The heterologous cellulase fusion construct of Claim 13 wherein the second catalytic domain is an *Acidothermus cellulolyticus* GH5A E1 catalytic domain.

16. The heterologous cellulase fusion construct of Claim 15 wherein the second catalytic domain is an *Acidothermus cellulolyticus* GH5A E1 catalytic domain having an amino acid sequence of at least 90% sequence identity with the sequence set forth in SEQ ID NO. 8.

17. The heterologous cellulase fusion construct of Claim 1 further comprising a terminator sequence located 3' to the second catalytic domain.

- 46 -

18. The heterologous cellulase fusion construct of Claim 1 further comprising a selectable marker.

19. A vector comprising in operable linkage from the 5' end;

- (a) a promoter of a filamentous fungus secretable protein;
- (b) a DNA molecule encoding a signal sequence;
- (c) a DNA molecule encoding a first catalytic domain, wherein said first catalytic domain is derived from a fungal exo-cellobiohydrolase;
- (d) a DNA molecule encoding a second catalytic domain, wherein said second catalytic domain is the catalytic domain of a cellulase; and
- (e) a terminator.

20. The vector according to Claim 19 further comprising a selectable marker.

21. The vector according to Claim 19 further comprising a linker located 3' of the first catalytic domain and 5' of the second catalytic domain.

22. The vector according to Claim 19 wherein the vector will lack the DNA sequence encoding cellulose binding domain of the first catalytic domain.

23. The vector according to Claim 19 further comprising a kexin site.

24. The vector according to Claim 19 wherein the second catalytic domain is derived from a bacterial cellulase.

25. The vector according to Claim 19 wherein the vector lacks the DNA sequence encoding cellulose binding domain of the cellulase of the second catalytic domain.

26. A fungal host cell transformed with a heterologous cellulase fusion construct according to Claim 1.

27. A fungal host cell transformed with a vector comprising a heterologous cellulase fusion construct according to Claim 19.

- 47 -

28. A recombinant fungal cell comprising a DNA sequence selected from the group consisting of a heterologous cellulase fusion construct and a vector comprising the heterologous cellulase fusion construct.

29. A fungal host cell according to Claim 26 wherein said fungal host cell is a *Trichoderma* host cell.

30. A fungal host cell according to Claim 29 wherein said *Trichoderma* host cell is a strain of *T. reesei*.

31. A fungal host cell according to Claim 29 wherein one or more of the native cellulase genes has been deleted from the fungal host cell.

32. A fungal host cell according to Claim 31 wherein the native cellulase genes are selected from the group consisting of *cbh1*, *cbh2*, *egl1* and *egl2*.

33. An isolated cellulase fusion protein having cellulolytic activity comprising  
(a) a first catalytic domain, wherein said first catalytic domain is an exo-cellobiohydrolase catalytic domain and  
(b) a second catalytic domain, wherein said second catalytic domain is derived from a cellulase.

34. An isolated cellulase fusion protein according to Claim 33 wherein the exo-cellobiohydrolase is a CBH1.

35. An isolated cellulase fusion protein according to Claim 33 wherein the second catalytic domain is derived from a bacterial cellulase.

36. An isolated cellulase fusion protein according to Claim 35 wherein the bacterial cellulase is an endoglucanase.

37. An isolated cellulase fusion protein according to Claim 35 wherein the bacterial cellulase is an exo-cellobiohydrolase.

- 48 -

38. An isolated cellulase fusion protein according to Claim 35 wherein the bacterial cellulase is derived from a strain of *Acidothermus cellulolyticus*.

39. A cellulolytic composition comprising the isolated cellulase fusion protein according to Claim 33.

40. A method of producing an enzyme having cellulolytic activity comprising:  
(a) stably transforming a filamentous fungal host cell with either a heterologous cellulase fusion construct according to Claim 1 or vector according to Claim 19;  
(b) cultivating the transformed fungal host cell under conditions suitable for said fungal host cell to produce an enzyme having cellulolytic activity; and  
(c) recovering said enzyme.

41. The method of producing an enzyme having cellulolytic activity according to Claim 40 wherein the filamentous fungal host cell is a *Trichoderma* cell.

42. The method of producing an enzyme having cellulolytic activity according to Claim 40 wherein the filamentous fungal host cell is a *T. reesei* host cell.

43. The method of producing an enzyme having cellulolytic activity according to Claim 40 wherein the exo-cellobiohydrolase is a CBH1 and the cellulase is selected from the group consisting of an *Acidothermus cellulolyticus* cellulase and a *Thermobifida fusca* cellulase.

44. The method of producing an enzyme having cellulolytic activity according to Claim 40 wherein the recovered enzyme is selected from the group consisting of a cellulase fusion protein, components of the cellulase fusion protein, a combination of the cellulase fusion protein and the components thereof.

45. The method of producing an enzyme having cellulolytic activity according to Claim 44 wherein the recovered enzyme(s) is purified

46. A *Trichoderma* host cell which expresses a cellulase fusion protein, wherein said fusion protein comprises a first catalytic domain, wherein the catalytic domain is

- 49 -

derived from an exo-cellobiohydrolase and a second catalytic domain, wherein the second catalytic domain is derived from a cellulase enzyme.

47. The *Trichoderma* host cell according to Claim 46 wherein the *Trichoderma* host cell is a *T. reesei* cell.

48. The *Trichoderma* host cell according to Claim 46 wherein the exo-cellobiohydrolase is a CBH1 and the cellulase is a bacterial cellulase.

49. The *Trichoderma* host cell according to Claim 48 wherein the bacterial cellulase is derived from an *Acidothermus cellulolyticus* cellulase.

50. The *Trichoderma* host cell according to Claim 49 wherein the bacterial cellulase is selected from the group consisting of an *Acidothermus cellulolyticus* E1, GH48 and GH74 cellulase.

51. The *Trichoderma* host cell according to Claim 46 wherein the fusion protein will lack the CBD of the cellulase.

52. The *Trichoderma* host cell according to Claim 46 wherein one or more of the native cellulase genes has been deleted from said *Trichoderma* host cell.

53. A fungal cellulase composition comprising a cellulase fusion protein or components thereof, wherein the fusion protein or components thereof is the product of a recombinant *Trichoderma* spp.